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of the positive and neutral bundles showed the hydrogen series lines in both.

The second point is that there is a sharp separation between the two bundles at the proper pressure. This shows that light is not emitted only during the return of a corpuscle to a positive centre, as very often assumed, for the neutrals cause light in a region where all free corpuscles have been swept out by the field. Also the sharp separation of the bundles shows that at these pressures changes take place slowly, so that if a positive were formed in the neutral bundle it would be deflected out before becoming neutralized again. We are thus led to conclude that *light excitation may occur directly because of the collision of a neutral particle with a neutral molecule of the gas.* We may regard the light emission as taking place during the rearrangement of the electrons in the atom after one has been detached by the collision (Stark's theory), or we may retain the picture underlying Bohr's theory, if we regard the displaced electron as not leaving entirely the centre to which it is attached.

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[1] E. Gehrcke and R. Seeliger, *Verh. D. Physik. Ges.*, **15**, 897 (1913); H. Rau, *Ber. Phys.-med. Ges.*, *Würzburg*, Feb. 1914; J. Frank and G. Herz, *Verh. D. Physik. Ges.*, **16**, 512 (1914); J. C. MacLennan and J. P. Henderson, *London, Proc. R. Soc.*, A., **91**, 485 (1915).

[2] J. Stark, *Leipzig, Ann. Physik.*, **13**, 390 (1904).

[3] A. Wehnelt, *Ibid.*, **14**, 464 (1904).

AN APPARENT DEPENDENCE OF THE APEX AND VELOCITY OF SOLAR MOTION, AS DETERMINED FROM RADIAL VELOCITIES, UPON PROPER MOTION

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The position of the solar apex which had been derived from the stars of class B both from proper motions and radial velocities differed so much from the apex derived from radial velocities of A stars, that an investigation was undertaken of the radial velocities of all of the spectra classes. The discordances were not only between the spectral classes as a whole but appeared to be between the results from northern and southern stars as well.

In the course of the work it was observed that frequently there appeared to be marked discordances between the radial velocities of stars whose proper motions also differed in size and sign. This, and the desire to test the effect of differences of distance as evidenced by proper motion, led to the separation of the stars in the classes A, F, G, and K according to proper motion in right ascension into four classes—0 to $^{s}.0049$, $^{s}.0050$ to $^{s}.0099$, and $^{s}.0100$ and over, designated respectively in the table as small, medium, and large, and the stars having 'contrary' parallactic signs, i.e., negative signs in the first and fourth quadrants of right ascension and positive signs in the second and third quadrants.

The sky was divided into areas approximately 30° square and the mean of the stars in each region treated as one observation. The results of least-squares solutions are given in the table. A and D are the right ascension and declination respectively, of the solar apex and $V_\odot$ the velocity of the solar system. As the stars of class B practically all fall in the small proper motion division, the results from them are included in that division in the table.

μ_α	SPECTRAL TYPE	NORTH			SOUTH		
		A	D	$V_\odot$	A	D	$V_\odot$
				km.			*km.*
Large	A	242°	+ 7°	−14.2	306°	+14°	−20.7
	F	254	+ 5	−23.2	238	−11	−13.1
	G	268	− 4	−36.4	287	− 6	−13.9
	K	277	+18	−26.3	298	+19	−30.0
		260	+ 6	−25.0	282	+ 4	−19.4
Medium	A	260	− 4	−22.6	305	+20	−14.5
	F	253	−17	−25.5	307	+19	−19.9
	G	272	+ 7	−37.6	246	− 6	−44.1
	K	262	−34	−25.2	232	+59	−21.3
		262	−12	−27.7	272	+23	−25.0
Small	A	260	+35	−17.7	261	+ 3	−20.2
	F	270	+37	−15.0	264	+32	−20.7
	G	271	+27	−14.6	242	+28	−12.4
	K	265	+32	−19.6	258	+39	−22.4
		266	+33	−16.7	256	+26	−18.9
	B	254	+27	−17.0	288	+31	−24.8
Contrary	A	209	+37	−12.2	240	+18	−18.9
	F	292	+58	−13.3	204	+32	− 8.4
	G	207	+80	−19.0	147	+ 1	− 6.4
	K	288	+44	−14.2	292	+60	−20.3
		249	+55	−14.7	221	+28	−13.5
	Omitting G	263	+46	−13.2	245	+37	−15.9

The principal conclusion from this investigation is that the position of the solar apex and the solar velocity appear to vary with the proper motions of the stars used in the determination, at least for the fainter naked-eye stars of the northern sky, the declination approaching the well-known ellipsoidal axis and the solar velocity increasing as we go from the stars of small and 'contrary' proper motion to those of medium and large proper motion.

Such variations of the position of the apex although apparently connected with distance or other conditions, would seem to point ultimately to some form of rotary or spiral motion among the stars themselves.

The details of the investigation, which is based upon Campbell's well-known catalogs of about 1300 radial velocities, will be published in the *Astrophysical Journal.*

CHANNELED GRATING SPECTRA, OBTAINED IN SUCCESSIVE DIFFRACTIONS

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The great variety of channelled spectra obtained, when white light is successively diffracted by two gratings, are referrable to the fringes of the diffraction of homogeneous light, observed *outside* the principal focal plane, on a spectrometer. In other words, if light of a given pure color (sodium, mercury) is used, a single grating suffices. Each line of the spectrum is resolved into well defined groups of fringes, if it is observed either in front of or behind the principal focal plane. The arrangement of fringes varies in marked degree with the distance of the plane observed, from the latter. If reflecting gratings are used, there is no other possible source of interferences; but reflecting and transmitting gratings show the phenomenon equally well.

After finding how easily the Fresnellian interferences of two virtual slits could be reproduced in the telescope and observed on either side of (before or behind) the plane of the sharp slit images, it seemed reasonable to suppose that the diffraction of a slit could also be produced and exhibited in this way; but the availability of this anticipation is attended with much greater difficulty. The image of a very distant slit does indeed show separated diffraction fringes on either side of the principal focal plane in the observing telescope. But they move right and left with the eye, in the same direction and in this respect do not at once recall the phenomena under consideration. Usually the blurred image, out of focus, is stringy, without definite structure.

To obtain sharp stationary fringes from an image of the slit, this image must be produced by the diffraction of a grating, having a dis-